The Impact of Bank Capital Requirements in Indonesia

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Abstract

This paper provides new evidence on the effects of bank capital requirements in Indonesia. In investigating the impact of bank capital requirements, we set up a simple model of the banking firm which can detect the impact of capital regulation on banks' behaviour as well as having possible effects on the economy. In estimation, we use monthly panel data of all the banks that existed between 1997-1999, during which the crisis and regulatory forbearance occurred. Based on our econometric tests, we choose the Fixed Effects panel regression model because the bank specific characteristics are found to be crucial in Indonesia. Overall, the results suggest that regulatory capital takes part in the change of Indonesian banks' behaviour. Bank credit is found to decelerate but with less than before the Indonesian government implemented a forbearance in capital requirements. The view that banks choose to shrink their balance sheet activities during the capital shocks is consistent with the findings.

Keywords: Capital Regulation, Panel Regression, Indonesia
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1 Introduction

After the seminal contribution by Miller and Modigliani in 1958 that shows the independency value of a firm to its capital structure in a frictionless world with full information and complete markets, capital had been the issue both in corporate and banking sectors. However, only in 1988 bank regulators of the G10 countries agreed to adopt the Basel Accord for their common capital requirements and recently it has been implemented in some 100 countries around the world. Such cross-border standardisation was designed to provide a level playing field for internationally active banks within the member countries and to strengthen the soundness and stability of the international banking system by encouraging international banking organisations to meet a common solvency requirement.

In spite of many convincing arguments for Basel Accord, there are concerns in developed countries of possible negative impact in the early phase of its implementation. From theoretical and empirical sights, capital requirements lead to a sudden contraction of bank lending. In other words, the fixed minimum requirement of capital changes the behaviour of banks to shrink their balance sheets and in effect, it creates a slowdown in the growth of economy. The concerns have also been expressed for less developed countries where the possible negative impact of capital requirements seems to be more relevant, given a larger role of banking system in emerging countries. This topic is of special interest in Indonesia, especially after many special events such as the full implementation of capital requirements in 1992, Asian crisis in 1997 and 1998 capital forbearance.

The economic reform and financial liberalisation caused lending boom in Indonesia through banks as the most important financial intermediaries. This is followed by roaring in consumption and asset prices and in return, while corporate and financial sectors enjoyed a very high growth of economic development, macroeconomic vulnerability increases due to riskier banks' portfolios. The Indonesian rupiah depreciated drastically, generating enormous defaults by firms and substantially banks which had borrowed unhedged foreign currency denominated loans. Several banks were critically undercapitalised, even long before the crisis commenced. Shocks to the bank capital resulting from the unstable market cuts the channel of bank credit since other alternative transmissions such as bond market are not developed. Unsatisfactory enforcement of bank regulations in the past meant that policies covering intra group lending, loan concentrations, and credit worthiness criteria were consistently broken with impunity.

Basel Accord suggests minimum bank capital adequacy of 8 percent for healthy established banks in well regulated and stable economies. Higher ratios are required for high risk or potentially volatile economies. However, during the crisis in Indonesia, most banks are technically insolvent and distinguishing among different levels of capital adequacy became a problem. Strict adherence to international capital standard was feared to deprive the funds needed for restructuring corporate sector. In 1998, exactly in the middle of the crisis, Bank Indonesia had therefore designed a program of regulatory relief or forbearance to assist troubled banks. This program led to low capital requirements but applied more strict rules which had demoralised the banking sector activities. While Bank Indonesia used moral suasion to encourage banks to meet the criteria in the period before the crisis, the forbearance supported regulators to penalise troubled banks into liquidation. Otherwise, they are required to enter the recapitalisation program if unable to meet the requirements.

This paper provides new evidence on the effects of bank capital requirements in Indonesia. In investigating the impact of bank capital requirements, we set up a simple model of the banking firm which can detect the impact of capital regulation on banks' behaviour as well as having possible effects on the economy. In estimation, we use monthly panel data of all the banks that existed between 1997-1999, during which the crisis and regulatory forbearance occurred. Based on our econometric tests, we choose the Fixed Effects panel regression model because the bank specific characteristics are found to be crucial in Indonesia. Overall, the results suggest that regulatory capital takes part in the change of Indonesian banks' behaviour. Bank credit is found to decelerate but with less than before the Indonesian government implemented a forbearance in capital requirements. The view that banks choose to shrink their balance sheet activities during the capital shocks is consistent with the findings.

The remainder of the paper is organised as follows. Section 2 surveys theories relating to the impact of capital requirements, and summaries the major alternative empirical hypothesis developed from the theories. Part of the section also explains bank capital regulation in Indonesia. Section 3 outlines the methodology which is employed in the study. Section 4 discusses the data and model specification. Results are presented in section 5. Finally, section 6 contains concluding remarks.

2 The Impact of Capital Requirements: Related Literature

The survey of evidence on the effectiveness of 1988 Basel Accord within the G10 countries has been carried out by the Bank of International Settlements as the host of the Accord (BIS 1999). In essence, there are two significant aspects that are commonly revealed by the literature. The first concentration of the study is to investigate whether banks fulfil the capital requirements by increasing capital or by altering the risk-weighted assets. Table 1 lists papers that look at this substitution effect study where most of which have concentrated on US banks. The literature begins with Shrieves and Dahl (1992) who use several periods of cross-section data on commercial banks in the US. The risk exposure and capital levels are simultaneously related in the their model[1]. They claim that the effectiveness of risk-based capital standard depends on how well the standard reflects the true risk exposure of the banks. Subsequently, Jacques and Nigro (1997) utilise three-stage least squares method of estimation for US banks in the period of 1990-1991 and find that capital regulation has a significant impact on risk and vice versa. Aggarwal and Jacques (1998) repeat the analysis of Shrieves and Dahl, employing a cross-sectional of US bank data for 1991, 1992 and 1993. They specifically examine the impact on bank behaviour of the 1991 FDICIA legislation and the Prompt Corrective Action (PCA) provisions which obliged supervisors to take specific actions when banks' capital ratios fell below certain trigger levels. Accordingly, they discover that banks in the undercapitalised categories

[1]Shrieves and Dahl (1992) adopt 1981 Standards for risk-based capital. In December 1981, the Federal Reserve and the Office of the Comptroller of the Currency (OCC) announced a common set of standards to apply to all the banks which they regulate. The Standards set a minimum capital ratio of 7% for community banks and 6.5% for regional banks.

increase their capital target ratios more quickly than other banks with higher initial capital.

Calibrating the model with empirical data from the US banking industry in 1984-1993, Calem and Rob (1996) assess quantitatively the impact of the risk-based capital standard. Their model assumes that a bank operates in a multi-period setting and bank capital may fluctuate over time depending on the realised returns on loans. The main finding is that higher capital requirements may lead to an increase of portfolio risk with greater effect on undercapitalised banks than well-capitalised ones. Slightly different way of testing the impact of capital regulation, Wall and Peterson (1995) assume that bank capital regulation creates constraint on the dynamics of bank capital. They claim that empirical studies abandon the nexus of bank model and regulatory model.

Recent studies, looking at the UK banks (Ediz, Michael, and Perraudin 1998) and the Swiss banks (Rime 2001) provide some useful insight from outside the US. Ediz *et al.* (1998) use confidential supervisory data including detailed information about the balance sheet and profit and loss account of all British banks during the period of 1989-1995 and apply the Random Effects model of panel regression for their econometric approach. The empirical insight from the paper offers evidence that regulation is effective as banks in the UK attempt to meet the capital requirements by directly boosting the capital. Still in the european context, Rime (2001) addresses the impact of capital requirements to Swiss banks by exploiting Shrieves and Dahl's methodology. His results indicate that Swiss banks are induced to increase their capital, but it does not affect the banks' risk-taking.

Some authors have also contributed the theoretical case for higher capital standards leading to a greater risk assumption and higher probability of failure. Among others, Koehn and Santomero (1980) and Kim and Santomero (1988), using a mean-variance framework to compare the bank's portfolio choice with and without a solvency regulation, show that capital requirements (both leverage and risk-based capital requirements) will introduce changes in the composition of the risky part of the bank's portfolio in such a way that risk is increased and the probability of failure may be higher. This distortion, according to Kim and Santomero, will disappear when regulators use correct measures of risk in the computation of the solvency ratio. Rochet (1992) extends the work of Koehn and Santomero and discovers the following: (i) capital regulations are unable to prevent banks from choosing a very specialised and very risky portfolios if the objective of commercial banks is maximisation of the market value of their future profits (value maximising banks), and (ii) conversely, if banks behave as portfolio managers (utility maximising banks), regulations can be effective, but only if the weights used in the computation of the ratio are proportional to the systemic risks of the assets. A further theoretical ground argues that a bank chooses portfolio with maximal risk and minimum diversification. Consequently, bank capital regulation is not sufficient for taking care of moral hazard (Blum 1999). Since deposit insurance induces banks to hold less capital and choose higher risk capital, Marshall and Prescott (2000) show that capital requirements directly reduce the default of probability and portfolio risk. They suggest that an optimal bank capital regulation is possible by supplementing state-contingent penalties based on bank's performance. Assuming the asset side of a bank is fixed, Vlaar (2000) finds that while inefficient banks see capital requirements as a burden, the profitability of efficient banks improve when the capital is binding.

The second portion of the literature, and most relevant to this paper, is to test whether

the enforcement of capital requirements can lead to a contraction in banks' supply of loans or best described as credit crunch. The term credit crunch has been addressed widely by credit channel literature under the notion of the bank lending channel[2]. This particular channel describes how monetary shocks to banks' balance sheet might affect the cost of finance for certain borrowers over and above the standard impact on finance costs of higher interest rates (Bernanke and Gertler 1995). When there is a monetary (or other related regulation) tightening, banks may find difficulties to acquire external funds such as deposits to finance lending. More importantly, changes in interest rates no longer summarise changes in the cost of funding for certain borrowers.

Banks may shrink both assets and liabilities due to capital regulation which would impact the economy in terms of the slowdown of credit supply. With a binding capital requirements, additional capital is needed to expand more lending. However, banks may prefer to shrink rather than to issue new equities due to the asymmetric information and lemons problems (Myers and Majluf 1984). A formal analysis by Blum and Hellwig (1995) shows a relationship between bank equity and bank lending may amplify macroeconomic cycles, tempting banks to lend less when times are bad and to lend more when times are good. More rigorously, Holmstrom and Tirole (1997) have addressed the importance of capital as determinants of investment, monitoring, interest rates and its macroeconomic implications for banks. From a simple model that captures equilibrium level of banks and firms in the credit market, they show that the macroeconomic magnitude of market-determined capital ratios as part of monitoring are procyclical which means higher during expansions and lower during recessions. By presenting the strong relationship between bank's asset side and liabilities side, Diamond and Rajan (2000) confirm that capital requirements have obvious effects in the short run which is credit crunch whereas delicate outcome in the long run which creates banks to be more risky in their performance.

From Table 2, it is clearly shown that studies on this topic capture more countries than previous attempts. This is because of global crisis in the late 1990s, during which many countries experience serious credit squeeze. By focusing on US data, Bernanke and Lown (1991) demonstrate that loan growth at individual banks during the recession of 1991-1992 is positively linked to initial capital ratios. In their study, a simple cross-sectional regression of loan growth on bank capital significantly proved the capital crunch hypothesis. Similarly, another empirical study concentrating merely on New England Banks to control many differences in loan demand by Peek and Rosengren (1995b) find the same evidence of capital crunch within the same period but focusing more on bank deposits. The authors define capital crunch as bank shrinkage resulting from binding capital requirements, while the term credit crunch is used in a situation where loan supply has fallen faster than loan demand, a possible but not a necessary outcome of capital crunch[3]. Banks with formal actions shrink at a significantly faster rate than those without (Peek and Rosengren 1995a). Formal regulatory actions are devised for troubled banks that cannot meet or satisfy the international Basel Accord and the informal actions such as memorandum of understanding (MOU)[4]. Using quarterly data on US commercial banks between September

[2]Another type of channel is called balance sheet channel which describes how the borrowers' financial health can affect finance supply.

[3]Richard Syron introduced for the first time the term capital crunch as the credit crunch resulted from a shortage in bank capital (Syron 1991).

[4]MOU is undertaken by US regulators to invite Board of Directors of troubled banks to improve their

1989 and December 1997, Furfine (2000) derives structural estimates of the impact of changes in capital requirements on bank lending growth and capital ratios. He shows formally and empirically that there is a robust correlation between the shocks to bank capital and a fall in lending.

Several research has been developed for Japanese banks' perspective and the results are consistent with the US data, especially in the beginning phase of Basel Accord. Ito and Sasaki (1998) provide evidence that individual Japanese banks with lower capital ratios had a tendency to issue more tier 2 capital (i.e. subordinated debts) and to reduce lending. This behaviour resulted from a sharp decline in the stock prices during summer 1990 when banks found less capital gains and thus more issuance on subordinated debts. Likewise, Kim and Moreno (1994), summarising from the aggregate data, find that the regulatory environment forced banking system in Japan to pay more attention to their capital positions, affecting the slowdown in the growth of lending. Furthermore, Woo (1999) performs cross-sectional regressions between bank capital and lending growth which supported capital crunch hypothesis during the early years of 1990s. By differentiating bank capital regulation into international and domestic standards, Honda (2002) finds that capital standard has significant effects on bank credit in Japan. The international standard reduced the credit slightly more than the domestic regulation[5]. In his estimation with Fixed Effects model, Honda includes unemployment rate to capture general business condition, logarithm of assets to absorb differences in the loan structure and land prices to control the real estate collapse after 1990 in Japan.

In the context of emerging countries, Chiuri, Ferri, and Majnoni (2001) argue that the introduction of higher minimum bank capital requirements may well induce an aggregate slowdown or contraction of bank credit. Their sample selection embraced 16 emerging countries, ten of which experienced both regulatory change and financial crises (Argentina, Brazil, Hungary, Korea, Malaysia, Mexico, Paraguay, Thailand, Turkey, and Venezuela) and other five non-crisis countries (Chile, Costa Rica, India, Poland, and Slovenia). The analysis, however, does not include Indonesia in their sample selection. It was in 1992 that the full implementation of minimum capital requirements for Indonesian banks had been introduced. Nevertheless, there are still limited studies focusing on the effectiveness of Capital Accord or the possibility of a slowdown in credit channel[6]. Extensive work has been performed to find an alternative path of risk modeling for capital adequacy assessment (Santoso 1999). Furthermore, Abdullah and Santoso (2000) claim that the current Capital Accord was unable to capture bank problems in Indonesia. They argue that risk-based capital requirements, which rely solely on credit risk, fail to assess the banks.

Two empirical studies have been devoted to find the evidence of credit crunch in Indonesia. Firstly, using the disequilibrium framework to distinguish the supply and demand for credit that has been the binding constraint, Ghosh and Ghosh (1999) find that as the banking system crisis deepened, the supply of real credit declined. Credit demand was also discovered to fall sharply as economic recession appeared. The second is the paper by

financial condition.

[5]International standard for capital regulation in Japan is 6 percent before 1991, 7.25 percent from 1991 to 1992 and 8 percent after 1992. Banks with domestic standard take values of 4 percent in his sample period.

[6]For studies concentrating on Indonesian banking crisis and the lessons to be learnt, see Santoso (2000) and Pangestu and Habir (2002).

Agung, Kumiarso, Pramono, Hutapea, Prasmuko, and Prastowo (2001) which shows the existence of credit crunch after the crisis. In formulating the model, Agung *et al.* extended the Ghosh and Ghosh framework into macro (disequilibrium framework) and micro (panel regression) effects. The concentration of the study, however, is more on the cause of slowdown in bank lending during 1994-2000 without taking into consideration the regulatory forbearance in 1998 nor the severe lost in capital during and after the crisis. Their main results are comparable to our analysis as they argue that the slowdown in lending growth was caused by the supply factor which proves the credit crunch hypothesis.

2.1 Bank Capital Regulation in Indonesia

To understand the interest and implication of the study, this section briefly explains bank capital regulation in Indonesia. Banking supervisory in Indonesia was coordinated under *Master Dokumen Pengawasan Bank* (MDPB) which includes the *Master Plan* (MP) and the *Detailed Action Plan* (DAP). Under the MP, Bank Indonesia as a sole regulator for the banking industry, conducts Special Surveillance (SS) and On-Site Supervisory Presence (OSP) to several banks that are deemed to be important for the economy (i.e. four state-owned banks and five national private banks). DAP consists of specifically important steps to follow the Core Principles on Effective Banking Supervision of the Bank of International Settlements.

A series of bank reform packages as part of financial liberalisation was introduced in the period of 1988-1999. Financial liberalisation tends to increase the intensity of competition among banks at the same time as banks are given greater freedom to allocate assets and determine interest rates. To stabilise this competition among banks, capital requirements which represent the main banking supervisory instrument in Indonesia was initiated as part of PAKTO (October 1988 package). Even though many banks are unable to meet the requirements, the Indonesian approach is fully consistent with the basic standards laid down in the Basel Accord. The accord suggests that banks were required to reach at a minimum of 8 percent Capital Adequacy Ratio (CAR) by the end of December 1992. Because of the recent financial crisis, Bank Indonesia adopts a regulatory relief or forbearance of CAR from 8 percent to 4 percent, notionally to provide a breathing space for the banks and their borrowers[7]. To enforce the performance of prudential capital regulation, International Monetary Fund has placed Technical Assistance which mainly helps the Special Surveillance's task.

Indonesian Banks would get administrative sanction or forced into the recapitalisation program if fail to meet the regulatory requirements (Pangestu and Habir 2002)[8]. The system adopted in such regulation is similar to the 1991 US Federal Deposit Insurance Corporation Improvement Act (FDICIA). While banks are not allowed to fail, it is vital that corrective action be taken, especially if banks still have a manageable cushion of capital. This is predominantly important since low or negative capital often entice bank managers to seek frantic solutions such as raising very high rates on deposits to finance

[7]The CAR is restored again to 8 percent in 2001. Bank Indonesia Act of 2001 replaces Bank Indonesia Act of 1992 and 1998.

[8]Before this program elevated, Bank Indonesia strived to persuade for higher solvency ratios by moral suasion.

high-risk borrowers or also known as gambling for resurrection (Dewatripont and Tirole 1994).

As in September 1998, the banking recapitalisation program was carried out by Indonesian Bank Restructuring Agency (IBRA), under the Ministry of Finance. The IBRA together with OSP supervise troubled banks and dispose banks' assets under its control[9]. In classifying which banks to go for the recapitalisation program, IBRA proposed three groups based on an audit by international accounting firms. Banks with CAR more than 4 percent were categorised A and could continue its operations. Between 4 percent and -25 percent of CAR, banks were categorised B and candidates of the program, provided that the owners could inject 20 percent of new capital to accomplish CAR of 4 percent. The last category, C, where banks had CAR less than -25 percent would be taken over or closed by IBRA unless they could supply more funds to be allocated in the recapitalisation program. In summary, although Indonesian banks faced a lower capital regulation, the situation post crisis pushed the regulator to strengthen the rule by means if violated, a bank is allocated to the recapitalisation program or even closed.

Almost all of the evidence shows that fixed minimum capital requirements can affect the real economy through reductions in lending when banks are capital constrained. In other words, empirical findings suggest that the capital value of the banking industry had an effect on lending. The studies mostly describe the developed countries experience which have advantages in the availability of virtually every bank data, with the exception of Chiuri *et al.* (2001). Notwithstanding, it is necessary to check the impact of capital requirement systems operating in other countries.

Studies of credit crunch in Indonesia have significantly supported the hypothesis, but leaving aside the role of capital regulation. Therefore, a careful assessment proves to require new empirical evidence. Experience from East Asian financial crisis suggests that banks chose to shrink both their assets and liabilities after the regulatory enforcement, affecting the economy defectively through credit crunch or capital crunch hypotheses (Chiuri *et al.* 2001). In this paper, we take Indonesia as the main consideration in checking the effectiveness of regulatory capital on bank balance sheet. More importantly, Indonesia experienced regulatory forbearance which is unique among other crisis emerging countries. We use the methodology advocated by Peek and Rosengren (1995b) in testing the regulatory capital and Indonesian bank behaviour.

3 Methodology

Testing the impact of fixed minimum capital regulation on banks' behaviour pose various challenges in empirical investigation. The foremost challenge is the difficulty of determining supply or demand driven contractions in intermediation. This problem, noted among others by Bernanke and Lown (1991), Peek and Rosengren (1995b) and Ghosh and Ghosh (1999), must be treated within any attempt to empirically model the interlink between bank balance sheet and sources of its shocks. Accordingly, we tackle this problem by employing a methodology proposed by Peek and Rosengren which can be simplified to model

[9]The separation of the duty is that Bank Indonesia assesses the condition of banks and those failing to meet certain standards are to be reviewed by IBRA.

the impact of changes in capital regulation on deposits and loans of the banks operating in Indonesia. Specifically, this framework can simply identify two sources of capital shortage. The first source is whether from loan losses which forced banks to write off capital or, secondly, from changes in regulation which raised banks' capital ratio. In the case of Indonesia, despite some of them eventually being closed or taken over, banks prefer to meet the 4 percent capital requirements by which this study will look at. The framework fits Indonesian case as it explores the condition of bank balance sheet during the crisis with regulatory change planted in the representation. Slightly different to Peek and Rosengren's methodology, in our estimated equations (section 4), we include some variables that are deemed necessary to stabilise the remaining differences in demand shocks across banks as well as macroeconomic conditions.

To explore how the implications of the two sources of shocks reflect to Indonesian banks performance, we use the Fixed Coefficient Model (FCM) with some extension to fit the analysed case. FCM is commonly used as the standard description of one period banking firm and industry which emphasises the asset-transformation function of financial intermediaries[10]. The bank's effort to maximise its profit is captured implicitly.

Consider a simplified one-period balance sheet of a bank:

Assets	Liabilities
Loans (L)	Deposits (D)
	Equity (K)

or mathematically can be expressed as:

$$A = L = D + K \tag{1}$$

We assume that a bank in this model has only one type of assets which is loans (L), and two types of liabilities which are bank capital (K) and total deposits (D).

The Basel Accord defines capital on a consolidated basis and applies risk-weighting coefficients to the assets. For simplicity, the model describes regulatory capital requirements as the total equity capital to assets (restricting to loans only) ratio:

$$KR = \frac{K}{L} \tag{2}$$

where KR denotes the capital requirements[11]. Specifically, a bank can only meet its capital requirements by either issuing more capital (equity) or decreasing assets. Although it is not necessary for our analysis, hitherto we can construct a risk-based capital adequacy ratio as $rKR = \frac{K}{wL}$ where rKR is risk based CAR and w is the risk-weighting coefficients applied to different type of assets. Simply rearrange equation (2), the supply determined loans can then be constructed as:

$$L = \frac{K}{KR} \tag{3}$$

[10]For a discussion of the influential papers in banking regulation, see Freixas and Rochet (1997).

[11]Following Peek and Rosengren, we can also see that bank behaviour is constrained by the required capital to assets ratio $K \geq KR \times A = KR \times L$ and furthermore $KR \times (D + K)$.

To see the effect of regulatory capital on liabilities, the deposit function needs to be attained using (1) and (3):

$$D = L - K = \frac{K}{KR} - K \tag{4}$$

which by total differentiation becomes:

$$dD = \left(\frac{1}{KR} - 1\right) dK + Kd\left(\frac{1}{KR}\right) \tag{5}$$

and similarly for loans by utilising (3):

$$dL = \left(\frac{1}{KR}\right) dK + Kd\left(\frac{1}{KR}\right) \tag{6}$$

Bank creates deposits to finance loans, resulting assets and liabilities to increase equally without any increase in capital. However, bank's behaviour alters only if there is an adverse movement to capital as what happened during the financial crisis in Indonesia. From (1) and (5), when a bank is not capital constrained by binding requirements ($KR \neq K/L$), a negative shock in capital ($dK < 0$) forced banks to increase deposits ($dD > 0$) or otherwise loans would fall. Similarly, as shown in (1) and (6), a reduction in capital compels banks to shrink loans but they would need to relinquish profitable loans. Accordingly, banks choose to increase deposits to reinstate some of their lost equity.

Conversely, the bank responds in a different way if capital is constrained by requirements ($KR \leq K/L$), affecting both deposits and loans to decrease[12]. If there is an increase in capital requirements ($dKR > 0$), a decline in capital determines a result of reduction in deposits and thus loans must decline to adjust the fallings (equation 5). In other words, if the capital ratio is binding, the decrease in bank capital ($dK < 0$) forces a proportional decrease in deposits ($dD < 0$). At the same time, it is easy to see from (6) that a negative shock of capital would shrink loans ($dL < 0$) or the dilemma of credit crunch. Note that an increase in the capital ratio would decrease loans and deposits when a bank is capital constrained. Under this condition, it is natural that banks reduce its supply of credit, as increasing the supply would add risky assets in balance sheet and more capital is required. Generally, in terms of loans, an increase in KR and a decrease in K would have a negative impact for capital constrained banks. From the liabilities side, these two correlations affect deposits in a similar way.

The regulatory forbearance in Indonesia implies a decrease of capital requirements from 8 percent to 4 percent. Thus, if the bank is capital constrained, the combination of crisis as in shocks to capital and regulatory softening as in a decrease in capital requirements ($dKR < 0$) would result a decrease in loans, depending on a decline in capital. This is somewhat expected by regulators in Indonesia, to give more channel of funds for restructuring effort. Similar to loans (equation (4)), banks would shrink deposits but less than the situation when there is an increase in capital requirements.

Some caveats need to be addressed in this model. First, as a matter of simplicity, we do not include any interest rate specifications for deposits and loans in the model. However, in the estimated equations (section 4), we provide the benchmark of Indonesian interest

[12]While banks are expected to meet or be above the regulatory requirements, some of them are still found to be below the minimum capital requirements because of the endogenous problem.

rate as one of the control variables. Second, this model is a one-period model in which all variables are assumed to be positive. Third, we assume that the deposits which serve as the marginal source of funds to banks are non-transaction accounts that have no reserve requirements (Peek and Rosengren 1995b). Finally, we disregard the asset and liability management by banks in a model.

The model aims at searching the capital crunch as a result of binding capital requirements. An outsized adverse shock to capital is a necessary but not a sufficient condition for capital crunch (Peek and Rosengren 1995b). The bank will shrink by less with capital remains well above the regulatory requirement or when the enforcement of capital requirements is not evident. Since its adoption in 1992, Capital Accord in Indonesia has hardly caused a drop in loans or deposits. This is due to a considerable increase in both lending capacity and bank credit in 1994-1996 (Agung *et al.* 2001). However, the regulatory forbearance of 4 percent in 1998 and large capital losses during the crisis reflected the situations of capital crunch described in the model.

4 Data and Model Specification

4.1 The Data

The bank data were obtained from the Department of Economic Research and Monetary Policy, Bank Indonesia[13]. In addition, the GDP and Indonesian SBI data were acquired from the Datastream. The samples are unbalanced panel data extracted from 140 banks during 1997-1999[14]. As this study concentrates on the effects of capital standard and its forbearance in 1998, January 1997 was selected as the beginning date to see the behaviour of banks before the reduction of regulatory capital. Indeed, 1997 was also the time that many banks were detected to have problems in Indonesia (Santoso 2000). The sample selection ends in December 1999 to avoid distortions from seasonal factors. Another reason to end the sample in this year is that the effect of regulation forbearance is not expected in the same year, rather it may spread in the following year. Consequently, the panel sums up to 5040 observations.

The sample of banks scrutinised in this task includes all commercial banks (state- and private-owned) supervised by Bank Indonesia. The liquidated banks before the end of 1999 were eliminated from the sample because the inclusion would have biased the results toward summarising the connections between capital and bank behaviour. As the model defines, liabilities side of each bank only contains total equity and deposits (in local and foreign currencies). Furthermore, the definition of assets as suggested by the Bank of International Settlements may complicate testing the capital crunch hypothesis. We then focus on total assets rather than test all different definitions of assets. This approach works effectively as the total equity to total assets is the proxy of risk-weighted CAR. Besides, the method is consistent with most studies which test the credit crunch or capital crunch hypotheses [15].

[13]The data is similar to the one used by Agung *et al.* (2001) and does not specify the name of individual bank.

[14]The data is unbalanced as there are some missing observations across times.

[15]See Table 2 for the list.

4.1.1 Preliminary Evidence

Table 3 presents the summary of Indonesian bank balance sheet statistics in the sample study. The trend of most variables in the table shows a large decline. In addition, from the standard deviation values, the dynamics of each variable show profound variability across banks. The striking finding is the standard deviation of change in capital which is 842.90 percent in 1997. This result shows that only a few of Indonesian banks with poor capitalisation were suffering from the financial crisis that happened in the middle of 1997. In contrast, the maximum of change in capital was very large, showing that some banks might have enjoyed the crisis. The probable explanation is that banks with good foreign exchange trading desks could obtain a massive profit during the turmoil[16]. From the mean value of change in capital in 1999, it is clear that the worth of bank capital has decreased significantly after the regulatory forbearance with poorly capitalised banks suffering the most.

The growth of deposits provides very valuable aspects for our analysis. During the early phase of the financial crisis, deposits grew rapidly as Indonesian banks increased their deposit rates. However, when Bank Indonesia implemented regulation forbearance, deposits fell drastically from 9.15 percent of mean growth in 1997 to only 2.10 percent in 1998 and -10.28 percent in 1999. The large spread of maximum and minimum rates of deposit growth in the whole sample may be associated with the flight of quality by depositors. Indeed, as the crisis spread out in December 1997, the depositors' flight to quality was allegedly the most extreme case[17]. In general, after the restriction of regulation in 1998 (although Bank Indonesia reduced the capital to assets ratio), the deposit growth of banks fell dramatically, showing the evidence of bank shrinking. This preliminary evidence supports our theoretical analysis in section 3.

Moreover, the mean growth of assets dropped slightly in the whole sample study and hit a low of 0.73 percent in the year after regulatory forbearance. The probable explanation for a plunge in assets is due to the behaviour of banks when forced to meet the capital requirements but having difficulties to raise more equity in the crashed market. As a consequent, banks choose to reduce their assets as predicted by the capital crunch hypothesis. This evidence is further supported by a large decrease in loans. When the crisis unfolded, the mean of growth plummeted significantly from 3.84 percent in 1997 to -2.12 percent in 1998. Bank lending as an important transmission mechanism in Indonesia was distracted heavily during this year, explaining the situation of credit crunch. Therefore, our data proves the credit crunch hypothesis which is consistent with the finding by Agung *et al.* (2001). As expected by the regulators, the mean growth of loans increased by 11.57 percent after the year of regulatory forbearance. The lower capital regulation was hoped to rise the credit channel by banks to fund the economic reformation effort.

In the sample period, the capital to assets ratio was well above the regulation, both before and after the regulatory forbearance. However, the minimum and maximum values

[16]Normally, foreign banks in Indonesia have a very sophisticated dealing room as well as better skills than the local competitors. Due to the nature of the data, we cannot distinguish the foreign and local banks.

[17]Flight to quality supposedly consisted of deposits shifting from small to large banks, as the latter were perceived too big to fail controversy or simply more likely to receive public sector support in the case of difficulties.

of capital to asset ratio show that some banks were still undercapitalised throughout the sample period[18]. As discussed above, banks attempted to meet the regulatory capital by lowering its assets, rather than boosting the capital. This suggests the shrinkage of overall banks' balance sheets. Therefore, the preliminary evidence proposes a situation of capital crunch.

4.2 Model Specification

In order to test for the effect of deposits and loan of a change to capital requirements, we utilise the Peek and Rosengren (1995b) approach with some adjustment composed to specifically convene the Indonesian case. Instead of using data for cross section banks, this study looks at a panel data specification for individual banks. Several benefits of panel data are shown by Baltagi (1995). Firstly, our panel data controls for bank individual heterogeneity within certain dynamic duration which cannot be found in time series or cross section studies. Secondly, as panel data is usually assembled on micro units, such as banks in our case, most variables can then be more accurately measured at the micro bank level and biases resulting from aggregation over banks are eliminated[19]. We try to minimise the limitations that may come up in panel data by carefully designing and collecting the sample data.

Moreover, the test takes account of control variables for macroeconomic effects during time period of the study. Peek and Rosengren do not include any macroeconomic variables as the sample collected only covers New England banks which they claim to be the region where many of the formal regulatory actions have been issued under the capital guidelines. Following Peek and Rosengren, the capital crunch hypothesis envisages that poorly capitalised banks will shrink deposits more rapidly than better-capitalised banks, holding the loan demand effects constant. As we can see in previous section, the change in deposits and in loans are a function of total capital and change in capital ratio. The following two equations are then estimated to test these hypotheses:

$$\frac{\Delta D_{i,t}}{A_{i,t-1}} = a_0 + \sum_{b=1}^{139} \mu_b + a_1 \frac{K_{i,t-1}}{A_{i,t-1}} + \left(a_2 + a_3 \frac{K_{i,t-1}}{A_{i,t-1}} \right) \frac{\Delta K_{i,t}}{A_{i,t-1}} + a_4 \log(A_{i,t}) + a_5 y_t + a_6 SBI_{t-1} + \varepsilon_{i,t} \quad (7)$$

$$\frac{\Delta L_{i,t}}{A_{i,t-1}} = b_0 + \sum_{b=1}^{139} \mu_b + b_1 \frac{K_{i,t-1}}{A_{i,t-1}} + \left(b_2 + b_3 \frac{K_{i,t-1}}{A_{i,t-1}} \right) \frac{\Delta K_{i,t}}{A_{i,t-1}} + b_4 \log(A_{i,t}) + b_5 y_t + b_6 SBI_{t-1} + \varepsilon_{i,t} \quad (8)$$

These two equations are the reduced forms of the systems exposed in section 3. The subscript i refers to the bank and t refers to the time period. The dependent variable of (7) is the change in deposits (ΔD) and of (8) is the change in loans (ΔL). Both variables and change in capital (ΔK) are normalised by the beginning of the year of total assets to reduce the potential heteroscedasticity problems with the error term. The idiosyncratic shocks of each bank is controlled by including the individual bank dummy variables (μ_b). In other words, we estimate the two equations above by the Fixed Effects Model.

[18]Note that the capital regulation is 8 percent in 1997 and 4 percent in 1999.

[19]Other advantages such as the ability to construct and test more complicated behavioural models than pure cross sections or pure time series data are implicitly found in our estimation.

Banks are not expected to fall below the minimum capital requirements, rather it is anticipated to adjust capital or assets to satisfy the regulator. Banks with capital to assets ratio below the required minimum would sense pressure to shrink independent to the current capital shock. Thus, banks with poor capitalisation is expected to have a sluggish growth in deposits or liabilities than better capitalised institutions. To capture this phenomena, the tests include the beginning of the year capital to assets ratio, with a_1 and b_1 are predicted to be positive[20]. The a_2 parameter defines the effect of changes in bank deposits to changes in bank capital and predicted to be positive, exposing the capital crunch hypothesis. Similarly, the relationship between a change in total capital on ΔL is captured by the estimation of b_2 and predicted to be positive.

During the crisis, Indonesian banks suffer macro negative shocks to their capital. Although there was a decrease in capital standard, the enforcement was still evident and substantially followed by a reduction in the supply of credit (shrinkage in the bank function). Banks with poor capitalisation that have negative shocks to capital will shrink their liabilities more than banks with better capitalisation experiencing the same shocks. In other words, the effect of changes in capital are smaller for banks with higher initial capital regulatory ratio. As a result, parameters a_3 and b_3 are predicted to be negative.

The study has also included several variables to take into account differences in the loan demand structure. Note that these variables are not included in the model (section 3). At the outset, Indonesian banks face various types of loans which influence different demand shocks in the industry. The demand for loans may vary depending upon the size of the borrower which resulted different size of deposit growth rates conditional on the size of banks. To control this predicament, the inclusion of logarithm of total assets ($\log(A)$) to control bank size would be beneficial. Other factors that may be important in controlling demand shocks are the growth of GDP (y) and the Indonesian monetary policy variable which is the Certificates of Bank Indonesia (SBI). SBI was introduced to absorb excess liquidity of banks and works as a tool for Bank Indonesia to manage reserves in the banking industry through open market operations. Thus, a_5 and b_5 are predicted to be positive whereas SBI is predicted to move negatively (positively) with changes in loans (deposits).

5 Empirical Results

Following Baltagi (1995), we test the null hypothesis $H_0 : \mu_b = 0$ for $b = 1, 2, \ldots, 139$, by performing F-test to confirm the superiority of Fixed Effects model[21]. In general, the F-tests indicate that H_0 is rejected at the significant level of 1 percent for changes in deposits and loans, apart from loans in the estimation of the full sample period. Despite this exception, the overall results support the Fixed Effects model estimates against the plain OLS estimates[22].

[20]The inclusion of lagged capital to asset ratios is also to mitigate the endogeneity problem (Peek and Rosengren 1995a, Peek and Rosengren 1995b, Chiuri, Ferri, and Majnoni 2001).

[21]Under the null hypothesis, OLS is consistent as there are no individual bank effects in the model, whereas under the alternative, Fixed Effects model is efficient.

[22]Nonetheless, the results of all panel regression models are reported in the two tables below.

As the sample data almost covers the entire Indonesian banks and the parametric shifts of regression explain the differences between banks, the use of Random Effects model is undesirable. For reassurance, the Hausman test is available for the test of the null hypothesis of the Random Effects model. If the null hypothesis is true, the Random Effects model estimates are reliable and asymptotically efficient. If the alternative hypothesis is true, however, the Random Effects model estimates are unreliable. Under the null hypothesis, the test statistics have the asymptotic chi-square distribution with 6 degrees of freedom (χ^2_6). Under the alternative, the test statistics tend to be large. For the changes in deposits regressions, the Hausman test statistics are 141.86 and 126.63 for the models with full sample period and the year of regulatory forbearance, respectively. The critical value from χ^2_6 is 12.59, which is far smaller than the test values. Similarly, changes in loans regressions have values of 77.921 and 62.606 for the Hausman tests which are far higher than the critical value. Therefore, the hypothesis that the individual effects are uncorrelated with the other regressors in our model can be rejected.

Overall, based on F-test, which is vital that there are individual effects, and the Hausman test, which puts forward that these effects are uncorrelated with other variables in model, we conclude that the Fixed Effects model is the better choice[23]. Although we are in favour of Fixed Effects model, the results of estimating equations (7) and (8) with all panel data models are reported in Table 4 and 5, respectively. The idea is to compare results with and without bank specific characteristics in the Indonesian data. To check further the availability of capital crunch hypothesis in Indonesian banks, these two tables also report the panel regression estimates only for the year of regulatory forbearance. We shall discuss the empirical results into two separate sections.

5.1 The Effects of Capital Regulation on Bank Deposits

The Fixed Effects model estimates are reported in columns two and five of Table 4. The coefficient of the initial bank capital requirement is strong and significant at the 5 percent confidence level. This result implies that the capital accord clearly had a significant positive relationship on bank deposits during the full sample period. However, throughout the year of regulatory forbearance, capital/asset ratio is not significant, seemingly due to this variable barely controls the demand for deposits in 1998. This is even true throughout the post crisis in Indonesia as banking system liabilities in real terms are reduced in size by withdrawals of bank deposits. In addition, this fact is supported by the curiosity of significant negative finding in SBI as the benchmark for deposit rates in Indonesia[24]. The coefficients on the change in capital are positive, as expected by the theoretical analysis in section 3, and statistically significant at 1 percent in both regressions. During the regulatory forbearance, the coefficients doubled, explaining a stronger positive relationship between changes in capital and changes in deposits which supported our hypothesis.

Parameter a_3 in the regressions is significantly negative as predicted by the capital

[23]According to Greene (2000), one can perform a Lagrange Multiplier test for the Random Effects model based on OLS residuals. However, given the two tests above, we can strongly conclude the significance of Fixed Effects model.

[24]The different result suggested by preliminary evidence may be due to a very large drop of change in deposits after 1998.

crunch hypothesis, the coefficient on the change in capital is smaller for well-capitalised banks than for poor-capitalised banks. The result is more significant during the year when CAR decreased to 4 percent. As discussed earlier, Indonesian regulation forbearance demonstrated a decrease in capital requirements but it was accompanied by the enforcement of capital regulation which had affected the banks' performance. Logarithm of total assets and growth in GDP which are proposed to control for differences in demand have significant estimated coefficients at 1 percent level in both the change in deposits regressions. Deposits grow at a higher pace for larger banks because depositors move their deposits to larger banks, as reflected in the positive and significant coefficients of $\log A$. This result is due to the Too Big To Fail hypothesis of Chiuri *et al.* (2001) which states the lower risk of closure for larger institutions. A very high results of GDP growth in both regressions suggest that condition in the economy strongly determines the behaviour of banks in Indonesia.

Finally, something must be said about other panel regression models in order to compare them with the Fixed Effects model estimates. All the demand factors in our estimates of change in deposits are highly significant and the values range closely to one another. For logarithm of assets estimates in Fixed Effects model, however, the values tend to be bigger. Since Fixed Effects model enables the basic model (OLS) to be rerun along with dummy variables for individual banks[25], this result means that some banks with bigger assets in their portfolio enjoy more development during the good times but suffer more when the crisis comes as it was shown rigourously by Holmstrom and Tirole (1997). The coefficients of change in capital also show similar results for all panel regression models. The estimates of parameter a_3 in all regressions provide useful insight in testing the regulatory impact. Given that the size of banks are controlled by $\log(A)$, lower but stricter capital regulation had a stronger impact on undercapitalised banks. The higher values on the year of capital forbearance seem to explain that Indonesian banks suffer even more after the start of the Banking Reform.

To sum up the results of equation (7), capital crunch hypothesis is identified among Indonesian banks. An attempt to raise capital ratios by banks with poor capitalisation had caused them to grow more slowly and shrink more rapidly. In addition, the notion of credit crunch was merely attributable to a decrease in loan demand is proven to be inconsistent as bank shrinkage may also come from the deposits side of bank balance sheet.

5.2 The Effects of Capital Regulation on Bank Loans

Columns two and five of Table 5 show that all of the coefficients are as expected but only variables to control the demand factors are highly significant. GDP as the fundamental economic factor has a positive relationship with changes in loans, consistent with the result of Agung *et al.* (2001). However, comparing the results to the change in deposits (previous subsection in this section), GDP growth has less effect to the change in loans. The possible explanation is the awareness of banks to be more caution in giving new loans during and after the crisis even though the economic condition is recovering. Consistent with US banks (Peek and Rosengren 1995b), Japanese banks (Honda 2002) and other emerging countries (Chiuri *et al.* 2001), the measure of logarithm of total assets in Indonesia is positive and

[25]Fixed Effects model is regularly identified as the least squares dummy variable (LSDV) model (Greene 2000).

statistically significant, indicating that the decline of loan demand is more pronounced for larger banks.

The small and insignificant results the capital regulation variable (parameter b_1) are the evidence of its weakness, at least for a change in loans. Another way to explain the insignificant of the capital ratio effect is to evoke that capital ratios are an endogenous variable chosen by banks. This effect is contradictory to Japanese banks (Honda 2002) and other emerging countries (Chiuri *et al.* 2001). As predicted by the theory, a change in capital corresponds positively to a change in loans but never significant in both regressions. Much higher coefficient of a change in capital during the year of regulatory forbearance is likely to be more relevant for Indonesian banks which were affected more sternly by the combination of severe shocks in capital market and the burden of capital ratio.

A negative relationship is found between parameter b_3 and a change in loans, but never significant in each of the regressions. This is probably due to all of the Indonesian banks (not only the small capitalisation banks) reduce their lending in the aftermath of crisis. Similar to the results of a change in deposits, coefficients of SBI are highly significant in all panel regression models. Using the Random Effects model, we discover a negative coefficient of capital to asset ratio for the entire sample period but, the same as other models, insignificant. The Random Effects model enables the basic model (OLS) to be rerun along with a different additive variance term for each bank, through a two-step feasible generalised least squares. These outcomes mean that capital ratio never gives any effect to the bank lending behaviour, consistent with Peek and Rosengren (1995b) but contrast with Honda (2002) who has found significant credit crunch hypothesis in Japan between 1987-1995. However, as suggested by the results of $K/A \times \Delta K/A$ coefficients in all models, banks with lower initial CAR decrease lending more rapidly when there is a shock to their capital.

In short, capital ratio, at least after the forbearance and as hoped by the regulators, took less part in determining the slowdown of credit among Indonesian banks[26]. This result is comparable to the study by Agung *et al.* (2001) which has argued the existence of credit crunch between 1994-00. In this paper, we bear in mind the 1998 forbearance which has been neglected by earlier studies. Our finding is that, as argued in the previous section and the insignificant results of the change in loans regressions, bank shrinkage comes more rapidly from the liabilities side of the banks.

The preliminary evidence (section 4) supports the hypothesis of credit crunch in the entire sample period. One way to explain the difference to the econometric result is due to banks with better capitalisation still enjoyed an increase in capital in the year of crisis but experienced a drastic decrease in the Indonesian post-crisis situation. Thus the change in loans which have decreased significantly during the crisis (see Table 3, in particular columns for Median and Maximum) were exposed to become more mild after the crisis[27].

[26] One may say that regulatory forbearance has worked to soften the credit crunch problems.

[27] As explained before, we capture this phenomena by employing Peek and Rosengren framework.

6 Concluding Remarks

This paper has documented the empirical evidence that the bank capital requirements had effects on banks' balance sheet in Indonesia. We have examined the Indonesian banks and their behaviour during the period of 1997-1999 by estimating a modified version of Peek and Rosengren (1995b)'s model. There are several significant points that emerged from the analysis.

Firstly, the main finding from the liabilities side of banks is that there was a strong positive relationship between bank capital and growth rate of deposits. Although there was a reduction in regulatory capital, the pressure was felt by Indonesian banks, especially for poor-capitalised banks. Secondly, with regards to bank lending, it was shown that credit crunch was less apparent in the aftermath of regulatory forbearance in Indonesia. To avoid credit crunch dilemma in the future, Indonesian government and the central bank have to develop alternative markets for credit channel while keeping strict capital regulation. Indonesian capital markets are not properly regulated yet and similarly, the recent development in financial market suggests that domestic bond as another alternative for capital raising is somewhat less attractive[28]. The government had issued several types of bonds to fund the recapitalisation program but they seemed to be unattractive in the market because the regulation for this market is unable to comfort investor's confidence. Therefore, deregulation is desirable, not only in the stock market but also in other markets such as commercial paper and bond markets.

Summing up the results from the effects on deposits and loans, there is a concern of poor-capitalised banks, most of which operate with low net worth relative to assets. Since their presence diminishes the economies of scale of the whole banking system (as these banks use up the implicit safety net), the government has set up an agency to deal with these troubled banks. Nevertheless, bank restructuring is a necessary but not a sufficient condition for economic recovery in Indonesia. To restore the confidence of depositors, a proper and explicit risk-based deposit insurance should be erected. Prudential regulation should be improved as well as its flexibility with new challenges. More importantly, supervisory agencies should focus on the monitoring of bank compliance to enforce sound banking practices[29].

Finally, this paper contributes to the lengthy discussion on the Capital Accord, especially to the economies that rely heavily on bank credit. The process of enforcement of a stricter bank capital discipline in developing countries calls particular attention. We have been convinced by the empirical results that Basel Accord changed adversely the behaviour of Indonesian banks. Since the Accord is internationally adopted, the amount of aggregate credit or money supply are determined by capital. If this happened to each country that sticks to the Accord, the global credit crunch could occur. This is not to say that Capital Accord is objectionable. Our results should, however, be treated as an input for the revision of new Capital Accord that currently remains in progress.

Notwithstanding, the study suggests a direction for further research. While we cover

[28] Agung (2000) finds that Indonesian firms faced financial constraints and agency costs (debt finance) in raising funds.

[29] Bank Indonesia decided to separate its regulation division by the end of 2002 into an independent financial services authority.

capital regulation and its impact to Indonesian banks, the result is limited to our sample period. A study covering an extended time period would be most useful, especially if the risk based and/or the new capital adequacy (Basel Accord II) are employed. Using the post-crisis data of Indonesian banks and testing it with the Basel II approach would allow us to see the probable impact of this new capital regulation which is expected to come into practice in 2004 (BIS 2001). In addition, Indonesia is expecting to have a deposit insurance program in 2004 thereby replacing the existing blanket guarantee (Abdullah and Santoso 2000). Research in this area is subsequently needed as capital regulation would react differently with the existence of other regulation instruments, especially deposit insurance.

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Author	Country and Period	Capital Approach	Capital Vs Risk-taking
Shrieves and Dahl (1992)	US 1984-86	1981 Standards	Positive Relationship
Wall and Peterson (1995)	US 1989-92	Basel Accord	Constrained Capital
Calem and Rob (1996)	US 1984-93	Basel Accord	Positive Relationship
Jacques and Nigro (1997)	US 1990-91	Basel Accord	Positive Relationship
Aggarwal and Jacques (1998)	US 1991-93	Basel Accord	Positive Relationship
Ediz *et al.* (1998)	UK 1989-95	Basel Accord	Positive Relationship
Rime (2001)	Switzerland 1989-95	Basel Accord	No Effect to Risk

Table 1: Substitution Effect of Capital Regulation

Author	Country and Period	Capital Approach	Macroeconomic Impact
Bernanke and Lown (1991)	US 1991-92	Capital Asset Ratio	Slowdown in Lending
Peek and Rosengren (1995a)	New England 1989-92	Capital Asset Ratio	Shrinkage in Loans
Peek and Rosengren (1995b)	New England 1990-91	Capital Asset Ratio	Shrinkage in Deposits
Woo (1999)	Japan 1990-91	Capital Asset Ratio	Capital Crunch Evidence
Ito and Sasaki (1998)	Japan 1990-93	Basel Accord	Lending Tightening
Honda (2002)	Japan 1986-95	Capital Standards	Bank Creidt Reduction
Furfine (2000)	US 1989-97	Basel Accord	Loan Growth Reduction
Chiuri *et al.* (2001)	Emerging 1993-99	Capital Asset Ratio	Bank Credit Contraction

Table 2: Macroeconomic Impact of Capital Regulation

Table 3: Bank Balance Sheet Summary Statistics 1997-1999

Summary statistics are given for 140 sample banks over the period 1997-1998. The statistics are calculated from monthly data. One month of each year is lost due to differencing. Contrary to Peek and Rosengren, this table does not classify the size of banks and thus some values are found to be very large. By providing mean, median, maximum, minimum and standard deviation of each variable in the table, the values can then be analysed for different bank capitalisation.

	Mean	Median	Maximum	Minimum	Std. Dev.
1997:1-1997:12					
Change in Assets (%)	4.24	2.31	1147.01	-92.43	31.32
Change in Loans (%)	3.84	1.85	1285.20	-58.02	33.93
Change in Deposits (%)	9.15	1.62	7900	-54.97	203.13
Change in Capital (%)	31.97	1.35	33025.09	-95.86	842.90
Capital / Asset	0.122	0.097	1.695	0.003	0.125
1998:1-1998:12					
Change in Assets (%)	1.64	0.28	186.13	-85.77	18.26
Change in Loans (%)	-2.12	-2.58	142.24	-69.71	12.65
Change in Deposits (%)	2.10	0.42	214.38	-68.03	19.31
Change in Capital (%)	52.81	0.47	30227.37	-97.44	860.12
Capital / Asset	0.095	0.069	3.046	0.000	0.111
1999:1-1999:12					
Change in Assets (%)	0.73	0.80	100.33	-71.13	12.57
Change in Loans (%)	-0.68	-1.02	773.14	-92.10	29.84
Change in Deposits (%)	0.79	0.66	169.35	-70.81	14.22
Change in Capital (%)	-10.28	0.90	35764.44	-56330.19	1710.36
Capital / Asset	0.083	0.075	2.609	-3.605	0.229

Table 4: Estimates of Changes in Deposits

The table reports the panel regression results of changes in deposits $\frac{\Delta D_{i,t}}{A_{i,t-1}} = a_0 + a_1 \frac{K_{i,t-1}}{A_{i,t-1}} + \left(a_2 + a_3 \frac{K_{i,t-1}}{A_{i,t-1}}\right) \frac{\Delta K_{i,t}}{A_{i,t-1}} + a_4 \log(A_{i,t}) + a_5 y_t + a_6 SBI_{t-1} + \varepsilon_{i,t}$ using OLS, Fixed Effects and Random Effects models for the full sample period and the year of capital forbearance. The dependent variable (ΔD) and the change in capital (ΔK) have been scaled by the beginning of the year value of total assets. F-value denotes the F test statistics which test the null hypothesis of the absence of individual bank fixed coefficients against the alternative hypothesis of the presence of individual bank coefficients. Under the null of the Hausman specification test, Random Effects model is efficient, whereas under the alternative, Fixed Effects model is consistent. Standard errors are in parentheses. *Significant at the 5 percent confidence level and **Significant at the 1 percent confidence level.

	Full Sample Period, 1997:1-1999:12			The Year of Capital Forbearance, 1998:1-1998:12		
Variable	OLS	Fixed Effects	Random Effects	OLS	Fixed Effects	Random Effects
Constant	0.0273		0.1059**	0.0241		0.1288
	(0.0626)		(0.0411)	(0.1170)		(0.0733)
K/A	0.1478*	0.1666*	0.0758	0.2888*	0.3137	0.2159**
	(0.0658)	(0.0829)	(0.0469)	(0.1189)	(0.1697)	(0.0779)
$\Delta K/A$	0.4633**	0.4001**	0.4428**	0.7899**	0.8399**	0.7744**
	(0.1371)	(0.1400)	(0.1337)	(0.2594)	(0.2704)	(0.2448)
$K/A \times \Delta K/A$	-1.7778**	-1.6671*	-1.6453**	-2.757*	-3.3243**	-2.6501*
	(0.6426)	(0.6606)	(0.6191)	(1.1087)	(1.1627)	(1.0331)
$\log(A)$	0.0142**	0.2352**	0.0092**	0.0259**	0.5666**	0.0189**
	(0.0039)	(0.0252)	(0.0022)	(0.0073)	(0.0610)	(0.0039)
Growth in GDP	1.8253**	2.0028**	1.8089**	1.5238**	2.0165**	1.5069**
	(0.2611)	(0.2629)	(0.2648)	(0.5529)	(0.5604)	(0.5684)
SBI	-0.0048**	-0.0048**	-0.0048**	-0.0165**	-0.0166**	-0.0165**
	(0.0005)	(0.0005)	(0.0005)	(0.0024)	(0.0025)	(0.0025)
R^2	0.0306	0.0639	0.0007	0.0562	0.1209	-0.0019
Adjusted R^2	0.0288	0.0216	-0.0011	0.0529	0.0379	-0.0055
Diagnostic Tests						
F-value(139, 4894)		1.2518*			2.5922*	
OLS vs. Fixed Effects						
Hausman Test			141.86			126.63
Fixed Effects vs. Random Effects						

Table 5: Estimates of Changes in Loans

The table reports the panel regression results of changes in loans $\frac{\Delta L_{i,t}}{A_{i,t-1}} = b_0 + b_1 \frac{K_{i,t-1}}{A_{i,t-1}} + \left(b_2 + b_3 \frac{K_{i,t-1}}{A_{i,t-1}}\right) \frac{\Delta K_{i,t}}{A_{i,t-1}} + b_4 \log(A_{i,t}) + b_5 y_t + b_6 SBI_{t-1} + \varepsilon_{i,t}$ using OLS, Fixed Effects and Random Effects models for the full sample period and the year of capital forbearance. The dependent variable (ΔL) and the change in capital (ΔK) have been scaled by the beginning of the year value of total assets. F-value denotes the F test statistics which test the null hypothesis of the absence of individual bank fixed coefficients against the alternative hypothesis of the presence of individual bank coefficients. Under the null of the Hausman specification test, Random Effects model is efficient, whereas under the alternative, Fixed Effects model is consistent. Standard errors are in parentheses. *Significant at the 5 percent confidence level and **Significant at the 1 percent confidence level.

	Full Sample Period, 1997:1-1999:12			The Year of Capital Forbearance, 1998:1-1998:12		
Variable	OLS	Fixed Effects	Random Effects	OLS	Fixed Effects	Random Effects
Constant	0.0178		0.0470**	-0.0115		0.0306
	(0.0255)		(0.0160)	(0.0477)		(0.0293)
K/A	0.0039	0.0006	-0.0168	0.0594	0.0784	0.0291
	(0.0269)	(0.0339)	(0.0180)	(0.0485)	(0.0697)	(0.0311)
$\Delta K/A$	0.1111*	0.0806	0.1151*	0.1864	0.1707	0.2632*
	(0.0559)	(0.0572)	(0.0541)	(0.1057)	(0.1110)	(0.0992)
$K/A \times \Delta K/A$	-0.2845	-0.2181	-0.2621	-0.5397	-0.6158	-0.8058*
	(0.2622)	(0.2699)	(0.2498)	(0.4518)	(0.4773)	(0.4185)
$\log(A)$	0.0038*	0.0916**	0.0019*	0.0101**	0.1966*	0.0075**
	(0.0016)	(0.0103)	(0.0008)	(0.0030)	(0.0250)	(0.0016)
Growth in GDP	0.6297**	0.6977**	0.6279**	0.2841	0.4471*	0.2983
	(0.1065)	(0.1074)	(0.1081)	(0.2253)	(0.2301)	(0.2320)
SBI	-0.0016**	-0.0016**	-0.0016**	-0.007**	-0.0071*	-0.0070**
	(0.0002)	(0.0002)	(0.0002)	(0.0010)	(0.0010)	(0.0010)
R^2	0.0186	0.0493	-0.1574	0.0477	0.0998	-0.2797
Adjusted R^2	0.0169	0.0064	-0.1595	0.0443	0.0147	-0.2843
Diagnostic Tests						
F-value(139, 4894)		1.1369			2.0364*	
OLS vs. Fixed Effects						
Hausman Test			77.921			62.606
Fixed Effects vs. Random Effects						